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APRIL 1984 NUMBER 188

Monthly Report on the Nuclear Fuel Market

NUEXCO

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

April 1984 No. 188

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NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of March 31, 1984 is **$17.00** per pound U_3O_8, down $0.50 since last month. The *Current Market Data* section of this Report lists nine uranium sales transactions, involving a total of approximately 2.5 million pounds U_3O_8 *equivalent*. All nine transactions involved spot or near-term deliveries; three involved deliveries of natural UF_6 and one was a sale of enriched product.

Active supply of uranium (U_3O_8 and UF_6) for spot and near-term delivery totals **6.1 million** pounds U_3O_8 or equivalent UF_6. The corresponding figure for **active demand** is **3.8 million** pounds. The spot and near-term **supply-demand ratio** fell to **1.6:1,** as buyer interest increased with the fall in offering prices.

The **Transaction Value** as of March 31, 1984 is **$19.25** per pound U_3O_8, down $3.25 since last month. The current Transaction Value includes 12 transactions involving a total of 3.2 million pounds U_3O_8 or equivalent UF_6 and covers a period of 5 months.

The **Loan Use Charge Rate** as of March 31, 1984 is **6 percent** per annum, unchanged since last month. No uranium loans are reported.

* * *

The Exchange Value fell $0.50 to $17.00 after an unusually active month of trading. More than 10 spot and near-term transactions, involving nearly 4 million pounds U_3O_8 equivalent, had been concluded or were nearing that stage by the end of March.

In the early part of March prices moved sharply lower, and dipped below $16.00 at mid-month before showing signs of recovery. Selling was dominated by utility and producer inventory holders intent on liquidating their stocks. Their willingness to offer prices below the $17.00 level elicited from producers as well as utilities a number of inquiries to purchase. The spot and near-term demand for natural uranium rose by more than 50 percent, to 3.8 million pounds.

The burst of activity that took place in early and mid-March seemed to clear the market temporarily of distress sellers. At the end of the month business could be concluded at or near the current Exchange Value, and few if any active sellers were willing to offer at prices much below that level. Given the current situation, three market scenarios seem plausible in the near future.

1. If buyers sense an end to the availability of bargain-priced inventory, they could seek business assertively, and prices could rebound sharply.

2. If the current level of supply remains stable and buyers continue to purchase with discretion, prices could remain stable near the $17.00 level.

3. If holders of large quantities of unneeded inventory, some of whom are not presently active, enter the market and cause a resumption of distress selling, prices could move downward again.

While the Exchange Value bottomed at $17.00 for two months in the third quarter of 1982, there is no reason to assume that it will not fall below that level in the future. Large amounts of inventory and excessive production are still present in the market, if not actively for sale. Economic, political and legal events external to the uranium market could release for liquidation much more inventory, which in turn could overwhelm demand.

* * *

The **Conversion Value** as of March 31, 1984 is **$0.80** per pound U as UF_6, up $0.50 since last month. This Report lists one conversion transaction, involving 50-100 thousand pounds U as UF_6. Active secondary market supply of conversion services for delivery within three years totals 3.6 million pounds U as UF_6, while active demand is approximately 65 thousand pounds.

The recovery of the Conversion Value during March was based on the withdrawal from the market of conversion sellers previously willing to swap natural UF_6 for U_3O_8 in exchange for minimal compensation for the conversion component of their UF_6. The current active sellers have available for sale a large amount of supply, but their offering prices appear to be stable at or near the current Value. The limited conversion demand is firm.

SECONDARY MARKET ENRICHMENT SERVICES

The secondary market **SWU Values** as of March 31, 1984 are **$100** for DOE origin and **FY85** delivery, and **$80** for **non-DOE origin** and delivery within approximately 15 months. The *Current Market Data* section of this Report lists ten secondary market SWU transactions involving a total of 630 thousand SWUs. Active secondary market supply of enrichment services totals approximately 1.5 million SWUs, while active demand amounts to 860 thousand SWUs.

* * *

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PRICING

Nuexco begins publishing a FY85 DOE origin SWU Value this month to reflect the concentration of activity in the market for FY85 deliveries rather than FY84. As of March 31, the market for FY84 SWUs is largely gone due to DOE's standard requirement of 180 days' notice prior to deliveries. In general, after March 31 a buyer seeking FY84 delivery from DOE must find a seller that has already ordered the desired enrichment assay, or that has in inventory product enriched to such a level.

Although ten secondary market SWU transactions are reported this month, and eight of those involve SWUs of DOE origin, it is difficult to characterize the secondary market for DOE origin SWUs at the present time because of the rather moderate response to date to the Utility Services enrichment contract (USEC). The activity taking place is in the range of $100 per SWU; precise offering prices have varied somewhat, largely because of varying tails specifications.

The demand for FY85 DOE origin SWUs comes from two classes of utilities:

1. Holders of Requirements contracts that intend to convert to the USEC; they can purchase up to 30 percent of requirements in the secondary market for DOE origin SWUs.

2. Holders of modified Interim Sales Contracts (ISCs); these few utilities can purchase up to 60 percent of FY85 requirements in the secondary market for DOE origin SWUs. Holders of modified ISCs are obligated to convert to the USEC if the USEC's terms are "no less favorable than those in the customer's existing Requirements-type contract when considered in its entirety."

Most Requirements contract holders have not yet made a final decision regarding the USEC because it is not clear that the USEC is a better bargain. Approximately 15 utilities have sent DOE letters of intent to convert to the new contract (only Duke Power has actually signed a USEC), but these customers are for the most part holders of Adjustable, Fixed-Commitment (AFC) contracts, for whom the USEC is an obvious improvement. Nuexco has calculated that AFC holders have excessive commitments to DOE amounting to over three million SWUs for FY85 alone, all of which is potential supply for the near-term secondary market.

One of the factors affecting Requirements customers' decisions to convert to the USEC will be the published price for SWUs under Requirements contracts (the new Requirements contract price, published on April 4, is $157, $22 more than the current USEC price of $135). However, a more important factor may be the question of economical long-term enrichment supply. Many Requirements contract holders undoubtedly are looking at the benefits associated with terminating their contracts and filling their future requirements with SWUs of non-DOE origin.

Indeed, several Requirements contract holders in the USA, Europe and Japan have already terminated contracts for several million SWUs in FY85 alone. To whatever extent those terminated SWUs were to have filled requirements, they constitute potential demand for non-DOE origin SWUs.

* * *

The **non-DOE origin SWU Value** declined $3 to $80 during March, as competition increased among non-DOE sellers to attract the business of utilities not yet committed to a primary enricher for the bulk of future SWU deliveries. DOE has made clear its wish to forestall utilities converting to the USEC from purchasing SWUs of non-DOE origin for deliveries prior to FY87. Thus, non-DOE suppliers have offered especially attractive terms in an effort to induce current DOE customers to forego future commitments to DOE. Sellers of secondary market non-DOE origin SWUs have in recent weeks been joined in their marketing efforts by primary market sellers, all hoping to increase their shares of the enrichment market.

DOE SWU PRICES (APRIL 4, 1984)

The Federal Register of the US Government has published the following new DOE SWU prices, which become effective 180 days after publication.

USEC: $135
Commitments: $153
Requirements: $157

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BIDS, OFFERS AND INQUIRIES

Introduction

As indicated in the *Pricing* section of this Report, the spot and near-term markets for natural uranium and for secondary market enrichment services have been unusually active during the past few weeks. In times such as these, when markets are tight, prices are fluctuating, or transactions are being concluded rapidly, knowledge of the precise meaning of terms and their correct usage greatly clarifies the mechanics of buying and selling uranium. The following paragraphs will review the meaning and usage of **bid, offer,** and **inquiry,** three terms that apply directly to the spot and near-term markets. The substance of these paragraphs appeared in earlier Nuexco Reports, most recently several years ago.

Bids and Offers

The use of the terms *bid* and *offer* by uranium market participants reflects standard security market and commodity market language. A *bid to buy*, or bid, is a recitation of definite terms under which one party expresses its assent to purchase certain material from another party. An *offer to sell*, or offer, is a recitation of definite terms under which one party expresses its assent to sell certain material to another party. Both bids and offers typically specify type of material, quantity, source, delivery location, delivery date, specifications, price, payment terms, validity date and any other conditions required by the bidder or offerer. The responses to an offer parallel those outlined below for a bid.

A party in receipt of a bid may do one of four things:

1. **Accept** the bid, in which case negotiations toward a final contract may proceed.

2. **Reject** the bid, in which case the bid is nullified. Upon receipt of a bid rejection, the bidder may withdraw from negotiations with the original party or submit an amended bid containing other terms. The bidder may also submit the original bid, or an amended bid, to one or more new parties, or resubmit the original bid to the original party, or choose some combination of the above options.

3. **Ignore** the bid, in which case the bidder may revoke the bid, or the bid may expire, either by operation of law or by an expiration date.

4. **Counter** the bid, in which case the party rejects the buyer's bid but specifies acceptable terms in a *counter-offer*. Upon receipt of a counter-offer, the original bidder may accept it, reject it, ignore it, or make a counter-bid.

When making bids and offers, the parties doing so must be aware that their bids and offers are subject to acceptance and that such acceptance, at the very least, obligates the parties to enter good faith negotiations towards a final contract. At the other extreme, such acceptance may carry with it the obligation of specific and immediate performance. The nature of the obligation resulting from acceptance is a function of the complexity and type of transaction. In the case of a straightforward transaction involving immediate delivery and payment, a bid or offer accepted in timely fashion by the party to whom the bid or offer was made may constitute an enforceable contract. In more complex or longer-term transactions, bids and offers may contain specific contingencies such as requirements for Board of Directors' approval, or particular terms or language specifically intended for resolution in subsequent negotiations, the objective of which is agreement on a formal contract document.

Thus, bids and offers should be sufficiently complete such that all the potential issues between the parties are at least acknowledged, if not settled. New demands that appear suddenly in final negotiations are unsettling and often lead to termination of negotiations.

Inquiries

Bids and offers by definition carry binding obligations to pursue a specific course of action, if accepted. All other approaches to the market by prospective buyers and sellers are termed inquiries.

1. The most familiar type of inquiry is the *competitive bid invitation* issued by utility companies. (This term is, of course, a misnomer, for what the utility actually does in issuing the invitation is to solicit *offers* from uranium sellers.) The reverse of the utility's competitive invitation is the *seller's auction*, in which the seller advises prospective buyers that certain material is available for sale, and invites them to bid for it.

In order for a utility's invitation or a seller's auction to be successful, the market must be stable or skewed in favor of the initiating party. "Success" in this context implies a number of responses reflecting a range of prices, terms and conditions from which the initiating party may choose. Maximum success (highest price for the seller or lowest price for the buyer) normally occurs when a strong market imbalance exists in favor of the initiating party. Thus, in a sellers' market characterized by excess demand and rising prices, the seller has the best opportunity to

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ESSAY

obtain a high price for his material. For the same reasons, a utility's competitive invitation has little chance of eliciting interesting offers to sell in a sellers' market.

Conversely, in a buyers' market, characterized by excess supply and falling prices, a seller's auction would be expected to draw scant attention and sellers would, instead, be expected to compete aggressively in response to any competitive invitations issued by p. ospective buyers.

2. A second type of inquiry is the *direct inquiry*, in which the prospective buyer (or seller) approaches the other party directly with the intent of negotiating a transaction without going through the competitive procedure outlined above.

While this approach often contains elements of the firm-bid, firm-offer approach, the negotiations do not typically start from such a formal position, but rather from a more generalized position such as, "I'd like to discuss my 1982-1992 requirements with you," or "You may be interested in some material I will have available for sale in the 1981-1987 period." The fact that one party has initiated the inquiry implies that he would like to do business. The discussions that follow are often a series of bids and offers that the participants make as they search for common ground.

The direct inquiry is most apt to be used when:

a. the initiating party has greater than average market sophistication, and feels confident enough of his market knowledge to ignore other potential buyers (or sellers) in favor of concentrating on what is deemed the most likely target;

b. a previous contractual relationship has existed or the parties have an ongoing relationship of some kind;

c. a competitive invitation or seller's auction has produced unsatisfactory responses;

d. the initiating party, for any number of reasons, wishes to protect his identity or conceal the fact that he is in the market.

The number and frequency with which these various approaches are used depends on the state of the market. What is effective in a sellers' market probably will not work in a buyers' market. However, effective marketing and procurement require that market participants understand the meaning, timeliness and application of these various approaches.

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CURRENT MARKET DATA

EXCHANGE VALUE $17.00/lb. U_3O_8
Determined as of March 31, 1984

Definition

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

Derivation

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

TRANSACTION VALUE[1]
Determined as of March 31, 1984

$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
19.25	3.2	12	5

Definition

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U_3O_8 in:

A. Transactions closed within the previous three-month period for which delivery was scheduled within one year of the transaction date;
B. At least ten transactions;
C. Transactions involving a sum total of at least two million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars as of the transaction date.

Comments

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable.
C. Transactions in which the delivery price is defined in such a way that it cannot currently be determined.

[1]Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. The corresponding data for 1982 are tabulated on page 5 of Report 173, and for 1983 on page 5 of Report 186.

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CURRENT MARKET DATA

LOAN USE CHARGE RATE[1] 6%
Determined as of March 31, 1984

Definition

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

Derivation

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrows and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[1]Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

CONVERSION VALUE $0.80/lb. U as UF_6
Determined as of March 31, 1984

Definition

The Conversion Value is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

Derivation

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.
C. Transportation charges other than those customarily provided by primary suppliers of conversion services.

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SWU VALUES

$100/SWU FOR DOE ORIGIN AND FY85 DELIVERY
$80/SWU FOR NON-DOE ORIGIN AND DELIVERY WITHIN 15 MONTHS
Determined as of March 31, 1984

Definition

The SWU (Separative Work Unit) Values represent Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.

Derivation

Nuexco bases the SWU Values upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent U_{235}) and a product assay of 3.0 weight percent U_{235} assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

Comments

Nuexco does not consider the following in determining the SWU Values:

A. The price of SWUs delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWUs delivered under other than arm's length transactions.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Mar. 31, 1984)	Last Month (Feb. 29, 1984)	12 Months Ago (Mar. 31, 1983)	This Month (Mar. 31, 1984)	Last Month (Feb. 29, 1984)	12 Months Ago (Mar. 31, 1983)
Australia (dollar)	18.12	18.54	25.68	47.11	48.20	66.76
Belgium (comm. franc)	905	933	1,070	2,353	2,426	2,781
Canada (dollar)	21.73	21.89	27.39	56.50	56.91	71.21
Finland (markka)	94.34	98.65	121.72	245.26	256.46	316.44
France (franc)	135.24	140.00	161.82	351.60	363.97	420.69
FRG (mark)	43.92	45.50	54.02	114.17	118.29	140.43
Italy (lira)	27,490	28,262	32,246	71,469	73,476	83,833
Japan (yen)	3,805	4,084	5,336	9,892	10,618	13,872
Netherlands (guilder)	49.53	51.33	60.89	128.78	133.46	158.31
South Africa (rand)	21.01	21.02	24.36	54.63	54.65	63.32
Spain (peseta)	2,518	2,611	3,048	6,547	6,788	7,924
Sweden (krona)	130.87	135.98	167.42	340.23	353.50	435.25
Switzerland (franc)	36.37	37.82	46.18	94.56	98.33	120.06
UK (pound)	11.71	11.71	15.16	30.43	30.44	39.40
US (dollar)	17.00	17.50	22.25	44.20	45.50	57.85

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Mar. 31, 1984)	Last Month (Feb. 29, 1984)	12 Months Ago (Mar. 31, 1983)	This Month (Mar. 31, 1984)	Last Month (Feb. 29, 1984)	12 Months Ago (Mar. 31, 1983)
Australia (dollar)	20.52	23.84	24.64	53.34	61.97	64.06
Belgium (comm. franc)	1,025	1,200	1,026	2,665	3,120	2,669
Canada (dollar)	24.61	28.15	26.28	63.97	73.17	68.33
Finland (markka)	106.83	126.83	116.79	277.72	329.73	303.64
France (franc)	153.14	180.00	155.27	398.14	467.96	403.67
FRG (mark)	49.73	58.50	51.83	129.28	152.09	134.75
Italy (lira)	31,129	36,337	30,942	80,928	94,469	80,442
Japan (yen)	4,308	5,251	5,120	11,201	13,651	13,311
Netherlands (guilder)	56.09	66.00	58.43	145.82	171.59	151.90
South Africa (rand)	23.79	27.03	23.37	61.86	70.26	60.76
Spain (peseta)	2,851	3,357	2,925	7,413	8,728	7,603
Sweden (krona)	148.19	174.83	160.65	385.26	454.51	417.65
Switzerland (franc)	41.19	48.63	44.31	107.07	126.42	115.20
UK (pound)	13.26	15.06	14.54	34.46	39.14	37.81
US (dollar)	19.25	22.50	21.35	50.05	58.50	55.51

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on March 30, 1984.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (Mar. 31, 1984)	Last Month (Feb. 29, 1984)	12 Months Ago (Mar. 31, 1983)	This Month (Mar. 31, 1984)	Last Month (Feb. 29, 1984)	12 Months Ago (Mar. 31, 1983)
Australia (dollar)	0.85	0.32	1.62	1.88	0.70	3.56
Belgium (comm. franc)	42.60	16.00	67.31	93.91	35.27	148.39
Canada (dollar)	1.02	0.38	1.72	2.25	0.83	3.80
Finland (markka)	4.44	1.69	7.66	9.79	3.73	16.88
France (franc)	6.36	2.40	10.18	14.03	5.29	22.45
FRG (mark)	2.07	0.78	3.40	4.56	1.72	7.49
Italy (lira)	1,294	484.50	2,029	2,852	1,068	4,473
Japan (yen)	179.05	70.01	335.73	394.74	154.35	740.16
Netherlands (guilder)	2.33	0.88	3.83	5.14	1.94	8.45
South Africa (rand)	0.99	0.36	1.53	2.18	0.79	3.38
Spain (peseta)	118.50	44.76	191.78	261.25	98.69	422.80
Sweden (krona)	6.16	2.33	10.53	13.58	5.14	23.22
Switzerland (franc)	1.71	0.65	2.91	3.77	1.43	6.41
UK (pound)	0.55	0.20	0.95	1.21	0.44	2.10
US (dollar)	0.80	0.30	1.40	1.76	0.66	3.09

SWU VALUES EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU FY85	Non-DOE SWU delivery within 15 months
Australia (dollar)	106.59	85.27
Belgium (comm. franc)	5,325	4,260
Canada (dollar)	127.83	102.26
Finland (markka)	554.94	443.95
France (franc)	795.54	636.44
FRG (mark)	258.33	206.66
Italy (lira)	61,708	129,366
Japan (yen)	22,381	17,905
Netherlands (guilder)	291.38	233.10
South Africa (rand)	123.61	98.89
Spain (peseta)	14,813	11,850
Sweden (krona)	769.82	615.86
Switzerland (franc)	213.95	171.16
UK (pound)	68.86	55.09
US (dollar)	100.00	80.00

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on March 30, 1984.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current E.V.	Seller	Buyer	Remarks
2776	1984-85	50-100	99-102	US Producer	US Utility	Fixed prices.
2775	1984	301-600	97	US Producer	European Utility	Inventory sale.
2773	1984	less than 50	91	European Entity	US Utility	UF_6. Inventory sale.
2769	1985	601-1,000	97	US Utility	European Broker	UF_6. Inventory sale.
2767	1984	101-300	85	US Utility	European Utility	UF_6. Inventory sale.
2766	1984-85	101-300	99-111	Canadian Producer	US Producer	Fixed prices.
2762	1984	101-300	indeterminate	European Entity	Far East Utility	Enriched UF_6. Included approximately 90,000 SWUs.
2737	1984	101-300	98	US Producer	US Producer	Inventory sale.
2736	1984	101-300	98	US Producer	US Utility	Inventory sale.

Secondary Market Conversion Services

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current C.V.	Seller	Buyer
2685	1984	50-100	38	European Entity	US Utility

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Secondary Market Enrichment Services

Nuexco Transaction Number	Delivery Period[2]	Approximate Quantity (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Tails Assay (Percent U^{235})	Seller Group	Buyer Group	SWU Origin	Remarks
2777	1986	50-100	indeterminate	to be determined	European Utility	US Utility	DOE	Discount from DOE price.
2774	1985	less than 50	98	0.25	European Entity	US Utility	Eurodif	
2772	1987	50-100	124	to be determined	European Entity	US Utility	Eurodif	Fixed price.
2771	1985	50-100	102	0.3	US Utility	US Utility	DOE	
2770	1984	50-100	99	0.2	US Utility	US Utility	DOE	
2768	1984	50-100	100	0.3	US Utility	US Utility	DOE	
2735	1984	50-100	unknown	unknown	US Utility	US Utility	DOE	Not arm's length.
2734	1986	less than 50	110	0.2	US Utility	Japanese Utility	DOE	Fixed price.
2733	1986	101-300	indeterminate	to be determined	European Utility	US Utility	DOE	Discount from DOE price.
2711	1984	less than 50	105	unknown	US Utility	US Utility	DOE	

[1]Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2]Refers to calendar year, not fiscal year.
[3]Price is not normalized to 0.20% tails assay.
[4]Refers to SWU Value for same origin as SWUs included in transaction.

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CURRENT MARKET DATA

URANIUM SUPPLY
(As of 3/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
1575	—	500 per year	
1818	—	500 per year	
2038	1,000	—	UF_6
2134	—	250 per year	1984-87
2201	95	—	
2236	—	200 per year	1985-89
2263	—	500 per year	1985-90
2275	135	—	
2297	—	200 per year	1985-89
2307	880	—	UF_6
2315	450	950	UF_6
2320	330	—	UF_6
2326	—	3,500	1988-91
2335	275	—	
2336	—	250 per year	
2365	20	—	
2368	—	2,800	
2376	50	—	
2389	300	—	
2390	100	—	
2392	35	—	UF_6
2436 A	850	—	enriched UF_6
2483 A	545	—	
2484	130	—	
2557	860	—	
TOTAL:	6,055		
INACTIVE			
0564	—	1,000 per year	1986-91
2017	1,100	1,200	
2191	125	—	UF_6
2193	—	800 per year	1986-90
2271	—	500 per year	1984-88
2429	450	—	
2473	—	500 per year	1984-88
TOTAL:	1,675		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

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URANIUM DEMAND
(As of 3/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2118	300	—	
2217	—	1,000 per year	1988-95
2302	—	330 per year	1988-94
2310 A	500	—	enriched UF_6
2329	—	500	1985
2352	300	—	
2355 A	—	1,400	enriched UF_6
2411	500	—	
2419	130	—	
2445	—	250 per year	1988-93
2456	650	—	UF_6
2463	260	—	UF_6
2468	310	—	UF_6
2470	780	—	UF_6
2502	60	—	
2558	—	235	1985 UF_6
2559	—	800	1987
TOTAL:	3,790		
INACTIVE			
1999	—	50 per year	1985-90
2244	—	350 per year	
2303	—	275 per year	1985-90
2372	—	100 per year	1985-88
2413	—	250 per year	1987 on
2414	—	150 per year	1987 on
2457	—	650	1987
2478	400	—	
TOTAL:	400		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(As of 3/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
2128	1,000	—	
2139	2,000	—	
2483 B	545	—	
TOTAL:	3,545		

CONVERSION SUPPLY AND DEMAND
(As of 3/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2051	1,000	—	
2141	2,200	—	
2397	200	—	
2438	220	220	1985-87
TOTAL:	3,620		
INACTIVE			
1936	1,000	—	
2401	600	—	
TOTAL:	1,600		
Inquiries to Purchase:			
ACTIVE			
2397	65	—	
TOTAL:	65		
INACTIVE			
2420	300	—	1986
TOTAL:	300		

[1]Measured from the date of this Report.

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SWU SUPPLY
(As of 3/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2100	—	100 per year	1986-87
2189	80	—	
2192	100	210	1986-87
2210	100	—	
2285	500	3,000	
2345	150	—	
2351	—	250 per year	1986-88
2378	130	250 per year	1987-88
2408	160	—	
2428	80	—	
2436 B	185	—	enriched UF_6
2469	—	80	1987
TOTAL:	1,485		
INACTIVE			
2337	250	250	
2359	180	—	
2375	200	—	
TOTAL:	630		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

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CURRENT MARKET DATA

SWU DEMAND
(As of 3/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2310 B	110	—	enriched UF_6
2346	—	30 per year	
2355 B	—	600	enriched UF_6
2372 A	120	30 per year	1986-90
2400	80	—	
2407	75	130	1986
2412	85	—	
2422	—	2,000	1985-94
2448	25	—	
2452	30	—	1985
2458	—	60 per year	1987-91
2465	—	400	1987-90
2475	300	300 per year	1988-90
2491	—	80 per year	1987 on
2496	35	35	1986
2503	—	330	1986
TOTAL:	860		
INACTIVE			
2142	35	15	1986
2237	—	250 per year	1987 on
2432	50	500	
2440	—	20 per year	1988-91
2449	50	—	
2459	50	50 per year	
2471	60	40 per year	
2567	—	45 per year	1987 on
TOTAL:	245		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

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AUSTRALIA

The Minister of Resources and Energy, Senator Walsh, has prepared a draft uranium policy that his party faction will propose at the Australian Labor Party (ALP) National Conference in July. The policy, if adopted, will provide the government flexibility to approve the expansion of the Australian uranium industry. The four points of the policy are:

1. To allow uranium export under stringent non-proliferation safeguards;
2. To withhold uranium exports from countries that do not observe non-proliferation conditions (including France, until France halts weapons testing in the South Pacific);
3. To support research and development of technology for high-level waste disposal;
4. To insure health standards, monitoring and protection of workers in the uranium industry.

Conspicuously absent from this policy is any commitment to limit the future development of uranium deposits. The federal government's existing policy, approved in November by the ALP caucus, specifically precludes development of any new uranium-producing mines except for the Olympic Dam deposit at Roxby Downs Station in South Australia. The Walsh proposal, representing the position of the center-left of the ALP, is a more positive, forward-looking stance than the existing policy, and is close to the view of Prime Minister Hawke (who would, however, prefer a more flexible position toward France). Rather than categorically oppose nuclear energy and withdraw from the uranium trade, the government in essence would support the beneficial aspects of nuclear energy while taking action to remedy the negative aspects.

How the proposal will be received at the Party conference is unclear. The anti-uranium wing of the ALP is vocal and stubborn. However, Prime Minister Hawke enjoys broad electoral support in Australia at the present time, and he continues to draw fresh support for his centrist policies from former opponents. Undoubtedly the objectives of Party unity and a display of confidence in the current leadership will favor the acceptance of the Walsh proposal.

Nevertheless, even if the Australian Labor government were to adopt such a stance formally, the prospects for the country's uranium industry would not be promising. Worldwide production, notably from new high-grade sources outside Australia, continues to exceed consumption by a margin of more than 15 million pounds annually, sustaining the growth in inventories. Prices are low and utilities' unfilled requirements are declining. Given this situation, there is little immediate incentive for prospective Australian producers to rush into the market. On the other hand, holding back now can only hurt their chances of gaining business that may arise in the long term.

JAPAN

Report 186 (February 1984) summarized the status of commercial nuclear power plants in Japan. In the subsequent two months, further progress has been achieved and modifications have been made to the expected commercial operation dates of several units.

Tokyo Electric Power's (TEPCO) Fukushima Unit II-2, an 1,100-MWe BWR, achieved commercial operation status on February 3, 1984. The event officially increased TEPCO's nuclear generating capacity to 6,896 MWe, 19 percent of the utility's total electricity generating capacity. The plant also increased the total number of nuclear units in commercial operation in Japan to 25, representing cumulative capacity of 18,277 MWe.

Onagawa Unit 1, a 524-MWe BWR owned by Tohoku Electric Power Company, and Sendai Unit 1, an 890-MWe PWR owned by Kyushu Electric Power Company, are undergoing power range testing. Commercial operations are expected in June and July 1984, respectively. Fuel loading is scheduled later this year for Takahama Unit 3, an 870-MWe PWR owned by Kansai Electric Power Company (Kansai); its commercial operation date is scheduled for February 1985. With the addition of these three units within the coming year, total nuclear generating capacity in Japan will exceed 20,000 MWe.

Several planned facilities have progressed toward licensing. TEPCO officially announced its intention to proceed with two additional 1,100-MWe BWRs, Kashiwazaki Units 3 and 4. The units, having scheduled commercial operation dates of mid-1993 and mid-1994, now enter the official planning stage. TEPCO expects the plans to be submitted to the Electric Power Resources Development Coordination Council (EPRDCC) early in 1985. (See the article in this Report entitled *Plant Licensing in Japan.*)

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RECENT DEVELOPMENTS

Kansai concluded successful negotiations with local governments to proceed with two 1,180-MWe PWRs, Ohi Units 3 and 4. Initial public hearings will be held within the next few months; submission for EPRDCC approval will be made this year. Respective operation dates for these two plants are mid-1990 and mid-1991.

Citing lower than predicted load growth, Hokkaido Electric Power Company announced delays for commercial operation of its first two nuclear reactors, Kyowa-Tomari Units 1 and 2, both 519-MWe PWRs. Commercial operation will be delayed six months for each, to June 1989 and June 1991.

* * *

The first nuclear power unit to operate commercially in Japan was Tokai Unit 1, a 166-MWe gas-cooled reactor that started operation in 1966. Its owner, Japan Atomic Power Company (JAPC), recently announced plans to undertake a major refurbishment program to increase the efficiency of the unit and extend its useful life for at least another decade. For some time, 18-year-old Tokai Unit 1 has been a candidate for decommissioning. JAPC decided against decommissioning primarily for two reasons.

1. Japan lacks adequate regulatory guidelines and current techniques for nuclear plant decommissioning.
2. Decommissioning could have had a psychologically negative effect in Japan at a time when the electricity generation industry is emphasizing to the public the advantages of nuclear energy.

* * *

In general Japan's utilities have reacted favorably to DOE's offer of the Utility Services enrichment contract (USEC). Their major concern regarding the contract, aside from pricing, seems to be how to adjust with DOE their requirements. The utilities have contracts with Eurodif to supply approximately 10 percent of requirements through 1990. They plan to take from their own domestic enrichment program approximately one million SWUs by the mid-1990s, and three million SWUs by the year 2000. In mid-March the Federation of Electric Power Companies announced that it intends the domestic enrichment program ultimately to provide one-third of commercial requirements.

Considering that the Japanese utilities are a huge source of business, DOE is likely to accommodate their concerns in order to maintain its dominant share of the Japanese market. DOE personnel recently have been discussing the USEC with utility personnel in Japan. Concurrently, however, European enrichment suppliers have been marketing in Japan as well. At least one European supplier has claimed to offer contract terms and conditions superior to those of the USEC.

SOUTH AFRICA

Palabora Mining Company (PMC) produced 482,000 pounds U_3O_8 in 1983, according to an announcement in late March. Adding the PMC figure to the 15,290,000 pounds produced at other operations (detailed on page 30 of Report 186) brings total 1983 South African U_3O_8 production to 15,772,000 pounds. PMC's U_3O_8 output, a by-product of its copper mining operations, declined by 15 percent from the 1982 level of 568,500 pounds, largely because of the variable grade of the carbonatite orebody.

* * *

On March 12 Harmony Gold Mining Company Ltd. announced the closure of its Merriespruit uranium recovery plant. The plant, commissioned in 1980 and one of three that Harmony operates, processed approximately 28 percent of Harmony's total 1983 U_3O_8 output of 1,374,000 pounds. According to the company announcement, production from the other two plants, together with the existing U_3O_8 stock, is sufficient to meet long-term committed sales. The announcement cited low uranium prices as the reason for the closure.

At the Merriespruit mine, ore is treated first for gold recovery at the Merriespruit gold plant. Slimes are then sent to the uranium plant for uranium recovery. The slimes from the uranium plant are finally pumped into tailings dams. When the uranium plant is closed, the gold plant slimes will be pumped to a new slimes dam to preserve the uranium-bearing material.

Harmony is the third South African uranium producer this year to announce plans to curtail operations. Blyvooruitzicht is planning to cease U_3O_8 production in August from its Number 6 slimes dam. Western Deep Levels, the country's smallest uranium producer, is considering converting its uranium plant to gold treatment. According to a company statement, conversion to a gold-treatment facility would greatly increase the plant's contribution to profits. If and when Harmony, Blyvooruitzicht and Western Deep Levels all cut back on uranium production, South Africa's production rate could be reduced by almost 10 percent.

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SPAIN

The government of Spain has announced the nation's new official nuclear energy plan. The new plan reduces the previous official capacity projection by providing for the indefinite deferral of five units that are under construction and two that were planned. Among the units shelved indefinitely are the twin Lemoniz PWRs in the Basque country, one of which is nearly complete and the other of which is almost 60 percent complete. Also deferred are Valdecaballeros Units 1 and 2 and Trillo Unit 2, which are in the early stages of construction. The government is now deciding how to cope with the financial implications of its decision. Only after the financial losses have been determined will the question of fuel pre-purchases be approached.

There are six units in commercial operation in Spain, and two others (Cofrentes and Asco Unit 2) are scheduled to begin commercial operation within the year (Table 1). Of the seven other units under construction, only two, Trillo Unit 1 and Vandellos Unit 2, have been approved. The government plan calls for ten units to be in commercial operation in 1992, having a total net generating capacity of 7,829 MWe.

Table 1

SPAIN'S CURRENT NUCLEAR PROGRAM

Unit	Utility	MWe Net	Type	COD
Operating				
Zorita[1]	Union Electrica	160	PWR	1968
Garona	Nuclenor	460	BWR	1970
Vandellos 1	Hifrensa[2]	500	GCR	1972
Almaraz 1	HE[3]/UE[4]/CSE[5]	930	PWR	1981
Almaraz 2	HE[3]/UE[4]/CSE[5]	930	PWR	1983
Asco 1	Fecsa[6]/Enher[7]	930	PWR	1983
Approved				
Cofrentes	Hidrola[8]	975	BWR	1984
Asco 2	Fecsa[6]/Enher[7]	930	PWR	1984
Trillo 1	UE[4]/Endesa[9]	1032	PWR	1987
Vandellos 2	Enher[7]/Fecsa[6]	982	PWR	1988
		7,829		
Indefinitely Deferred				**Percent Complete**
Lemoniz 1	Iberduero	900	PWR	97
Lemoniz 2	Iberduero	900	PWR	57
Valdecaballeros 1	HE[3]/CSE[5]	975	BWR	5
Valdecaballeros 2	HE[3]/CSE[5]	975	BWR	2
Trillo 2	UE[4]/Endesa[9]	997	PWR	0
Regodola	Fedeno[10]	1000	PWR	0
Sayago	Iberduero	1075	PWR	0
		6,822		

[1]Also known as Jose Cabrera.
[2]Hifrensa = Hispano-Francesa de Energia Nuclear S.A.
[3]HE = Hidroelectrica Española S.A.
[4]UE = Union Electrica.
[5]CSE = Compania Sevillana de Electricidad S.A.
[6]Fecsa = Fuerras Electricas de Cataluna S.A.
[7]Enher = Empresa Nacional Hidroelectrica Ribagorzana.
[8]Hidrola = Hidroelectrica Española S.A.
[9]Endesa = Empresa Nacional de Electrica S.A. (Owned by Institutio Nacional de Industria.)
[10]Fuerzas Electricas del Noroeste.

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NUEXCO

ANALYSIS & COMMENTARY

US NUCLEAR POWER PLANT BACKLOG

The December 31, 1981 *Nuclear News* "World List of Nuclear Power Plants" showed 91 nuclear power units as under construction or on order in the USA. Two years later, the December 31, 1983 list shows 59 units in these categories; 32 units were cancelled in the intervening two years.

Since the publication of the latest *Nuclear News* list, Cincinnati Gas & Electric announced its intention to convert its Zimmer unit to a coal-fired plant, Public Service of Indiana "withdrew from" (i.e., stopped financial support of) the two-unit Marble Hill project, and Gulf States Utilities Co. officially cancelled River Bend 2. Thus, there are now 55 nuclear units officially under construction or on order. Of these 55 units, the 7 listed in Table 2 have been indefinitely delayed.

Table 2

INDEFINITELY DELAYED NUCLEAR UNITS IN THE USA

Unit	Utility	MWe Net	Type	Percent Complete
Midland 1	Cons. Pwr.	425	PWR	85
Hartsville A-1	TVA	1233	BWR	44
Hartsville A-2	TVA	1233	BWR	34
Yellow Creek 1	TVA	1285	PWR	35
Yellow Creek 2	TVA	1285	PWR	3
WNP 1	WPPSS	1250	PWR	62
WNP 3	WPPSS	1240	PWR	75

Two of the remaining 48 units, Commonwealth Edison's Carroll County Units 1 and 2, are on order, but have had no construction progress made. That leaves 46 units making up the current backlog of nuclear power plants under construction in the USA. Table 3 lists these 46 units in order of completion percentage as of December 31, 1983. The table also shows the completion percentage of each unit as of December 31, 1981, and the progress (expressed in percentage points) made on each unit over the past two years.

A few of the units listed in Table 3, Arizona Public Service's Palo Verde Unit 3 for example, have made extraordinarily good progress over the past two years. Others, for various well-publicized reasons, have made no progress at all. The average change in completion percentage was an increase of 15.6 percent, unexceptional by current international standards. A breakdown of the change in completion percentages is shown in Table 4.

Table 4

CHANGE IN COMPLETION PERCENTAGES OF US BACKLOG SINCE 1981

Change in Completion Percentage	Number of Units
50–60	1
40–49	2
30–39	6
20–29	7
10–19	13
0– 9	13
negative	4
Total	46

Table 5 lists the number of units that are currently within each ten-percent range of completion percentages. What is striking is that 29 of the 46 units that comprise the US backlog are more than 80 percent complete. Eighteen units (almost 40 percent) are more than 90 percent complete. Seven of those eighteen are currently licensed for fuel loading and testing and could begin commercial operation during 1984; the remaining eleven could be licensed and operating before the end of 1985.

Table 5

COMPLETION PERCENTAGES OF US BACKLOG

Percent Complete	Number of Units
91–100	18
81– 90	11
71– 80	3
61– 70	6
51– 60	2
41– 50	2
31– 40	0
21– 30	3
11– 20	1
0– 10	0
Total	46

The recent avalanche of negative news for the US nuclear industry could be offset by a string of new units becoming commercial, if the Nuclear Regulatory Commission begins to clear this backlog with licensing approvals. However, recent history suggests that unanticipated problems will cause numerous delays of undetermined length

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Table 3

US NUCLEAR POWER PLANT BACKLOG

Unit	Utility	Percent Complete Jan. 1982[1]	Percent Complete Jan. 1984[2]	Change in Completion Percentage
Diablo 1	PG&E	100	100	0
McGuire 2	Duke Power	95	100	5
Grand Gulf 1	Middle South	95	100	5
WNP 1	WPPSS	87	100	13
LaSalle 2	Commonwealth Ed.	84	100	16
San Onofre 3	So. Cal. Ed.	78	100	22
Susquehanna 2	Penn. P&L	65	100	35
Palo Verde 1	Arizona PS	95	99	4
Waterford 3	Middle South	92	99	7
Shoreham	Lilco	87	99	12
Palo Verde 2	Arizona PS	74	99	25
Catawba 1	Duke Power	87	98	11
Fermi 2	Detroit Ed.	85	98	13
Callaway 1	Union Elec.	76	98	22
Comanche Peak 1	Texas Util. Co.	86	97	11
Watts Bar 1	TVA	77	96	19
Diablo 2	PG&E	91	95	4
Byron 1	Commonwealth Ed.	79	93	14
Perry 1	Capco	79	90	11
Wolf Creek	Kansas G&E	74	90	16
Limerick 1	Phil. Elec.	68	90	22
Seabrook 1	PS New Hamps.	55	89	34
Midland 2	Consumers Power	73	85	12
Harris 1	Carolina P&L	54	85	31
Palo Verde 3	Arizona PS	28	83	55
Clinton 1	Illinois Power	80	82	2
River Bend 1	Gulf States	39	82	43
Millstone 3	Northeast Util.	45	81	36
Hope Creek 1	Pub. Serv. E&G	42	81	39
Beaver Valley 2	Capco	48	78	30
Nine Mile Pt. 2	Niagara Mohawk	37	78	41
Bellefonte 1	TVA	77	76	(1)
Braidwood 1	Commonwealth Ed.	61	70	9
Byron 2	Commonwealth Ed.	63	67	4
Comanche Peak 2	Texas Util. Co.	46	65	19
Catawba 2	Duke Power	37	62	25
Watts Bar 2	TVA	63	61	(2)
Vogtle 1	Southern Co.	32	61	29
Bellefonte 2	TVA	61	57	(4)
Braidwood 2	Commonwealth Ed.	48	54	6
South Texas 1	STP	60	50	(10)
Perry 2	Capco	40	42	2
Limerick 2	Phil. Elec.	30	30	0
Seabrook 2	PS New Hamps.	9	29	20
South Texas 2	STP	23	25	2
Vogtle 2	Southern Co.	9	20	11

[1]As listed in the *Nuclear News* "World List of Nuclear Power Plants" for December 31, 1981.

[2]As listed in the *Nuclear News* "World List" for December 31, 1983, or other publications.

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ANALYSIS & COMMENTARY

NUCLEAR POWER PLANT LICENSING IN JAPAN

Introduction

Having consistently built plants on schedule and within budget, Japanese utilities have a reputation for efficiency in the implementation of their commercial nuclear power programs. A range of political, economic and cultural explanations may be cited for this success. The most important reason, however, is that licenses for plant construction are not issued until virtually all of the regulatory obstacles to the plant have been cleared. Several years of coordinated planning by utilities and the government precede the issuance of a single license that authorizes both plant construction and operation.

Legislative Background

Two laws passed in 1955 created the foundation for commercial nuclear power in Japan:

1. The *Atomic Energy Basic Law* declared the nation's intent to promote and develop nuclear power, and vested in the Prime Minister and his Cabinet the responsibility to formulate nuclear power policies.

2. The *Law for Establishment of the Atomic Energy Commision* (AEC) created the administrative vehicle to implement the objectives of the Atomic Energy Basic Law.

In the years following passage of these acts, the government passed two additional acts outlining plant licensing and enforcement of state regulations regarding nuclear power plants.

1. Passed in 1957, the *Law for the Regulation of Nuclear Source Materials, Nuclear Fuel Material, and Reactors*, in conjunction with related orders and interpretations, specified that permission to build a nuclear plant must be granted by the Prime Minister, and only after the conclusion of environmental evaluations and the advice of special committees on plant safety. Permission would be granted in the form of a license known as an "Establishment Permit," which would allow at once for both construction and operation (subject to plant inspections at periodic intervals).

2. The *Electric Enterprise Law* of 1964 defined design standards and requirements for equipment, construction, welding, preoperational testing, operation, periodic maintenance, and in-service inspection. It assigned responsibility for enforcement of standards to the Ministry of International Trade and Industry (MITI), which department also monitors the construction and operation of fossil fuel and hydroelectric power plants.

The Planning Process

Nuclear plant licensing in Japan ordinarily takes between one and two years, but a proposed plant does not begin to undergo licensing until after *three to four years of planning*. The Japanese utilities interact closely with the national government in planning to fulfill the power needs of their service territories. Two national government bodies, MITI and the Electric Power Resources Development Coordination Council (EPRDCC), develop and coordinate plans for power supply. MITI establishes Japan's official electricity generating capacity targets after carefully assessing national economic goals and the needs of the utilities. Because of MITI's strategic concern with the Japanese economy, utilities wishing to sell uranium or SWUs must first receive MITI's authorization.

EPRDCC, composed of the Minister for MITI, the Minister of the Economic Planning Agency, and selected representatives of government, industry and academia, performs the following functions during plant planning:

1. Reviews the utility's generation needs;
2. Approves plant generating capacity;
3. Ensures local public acceptance;
4. Guarantees that environmental reviews are adequate;
5. Grants formal approval of a plant site.

Planning is complete when EPRDCC formally approves the plant site proposed by the utility. Thus, licensing only begins after the national government has recognized the desirability of the new plant and approved its siting.

Figure 1 diagrams the steps involved in plant planning. The utility initiates site feasibility studies, emphasizing discussion with the local governments and communities. In selecting a site, the utility conducts a preliminary environmental evaluation and obtains the approval of the Environmental Protection Agency and the local government. Concurrently, the utility attempts to conclude agreements with local interests—for example, fishermen's associations.

Upon receipt of preliminary legal and local governmental clearance for the preferred site, the utility prepares an Environmental Impact Report (EIR) for submission to MITI, which is responsible for environmental reviews of all power plants in Japan. After receiving the EIR, MITI sponsors a public hearing, held in the locale of the proposed site, at which the utility presents its case for the plant. The results of the hearing and of related government reviews of the EIR are submitted to EPRDCC. With the concurrence of the Prime Minister,

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EPRDCC may grant final plant site approval. Upon EPRDCC approval the planned facility becomes an official project ready to undergo licensing.

Licensing

Figure 2 diagrams the licensing steps that follow EPRDCC approval of the plant site. For the first few commercial nuclear power plants built in Japan, MITI undertook sole responsibility for analysis of plant design and safety specifications. Problems that arose with some of those early plants led to public criticism of the licensing process. As a result, the government modified the licensing procedure to include independent reviews of design and safety specifications. Two independent bodies, the Atomic Energy Commission (AEC) and the Nuclear Safety Commission (NSC), now work with MITI in licensing.

The utility first submits plant design and safety specifications to MITI for a thorough evaluation. The specifications and MITI's evaluation are then passed on to the AEC and NSC. The AEC ensures plant conformance to the Atomic Energy Basic Law, and the NSC analyzes the technical soundness of MITI's design and safety evaluation. The NSC sponsors a second public hearing on the plant, also held in the locale of the plant site, at which MITI presents its evaluation of the utility's licensing application. When MITI, the AEC and the NSC all have approved the plant proposal, the Prime Minister of Japan may instruct the Minister of MITI to issue the Establishment Permit, thereby enabling the utility to draft its construction schedule and confirm the plant order.

Construction

Actual groundbreaking may not begin until the details of the plant construction schedule have been approved by MITI, and the local government has issued conventional building permits. Normally the construction permit process takes six to nine months after issuance of the Establishment Permit. The utility may not sign official contracts with its contractors and hardware suppliers until MITI approval and building permits have been granted. However, contractors and vendors are selected long before actual contract signing. They work closely with the utility to prepare the plant design information submitted with the license application. (For information about the industrial groups involved in the construction of nuclear plants in Japan, see *Japan's Nuclear Power Infrastructure* in Report 185 of January 1984.)

Average construction time for a single-unit 1000-MWe nuclear plant in Japan is 54–58 months, the fastest rate in the world. In accordance with the Electric Enterprise Law, MITI oversees all steps of the construction process, monitors preoperational testing, authorizes commercial operation, and subsequently oversees routine maintenance and in-service inspections. Hardware inspections are performed during fabrication at vendor facilities as well as during assembly and installation at plant sites. Generally 6–12 months elapse from the time MITI authorizes fuel loading and low power testing to the commencement of commercial operation.

Summary

While an average of 9–11 years transpires between the time a utility begins planning for a nuclear plant and the date the plant actually begins commercial operation, only half of that time on average is spent in the expensive construction phase. Ordinarily, the schedule for plant construction proceeds as follows:

1. Planning (through EPRDCC approval): 36–48 months;
2. Licensing (through issuance of the Establishment Permit): 12–24 months;
3. Construction scheduling and issuance of building permits: 6–9 months;
4. Plant construction (through loading of first core): 54–58 months;
5. Fuel loading to commercial operation: 6–12 months.

Once the Establishment Permit is issued, there are no superfluous obstacles to commercial operation. In Japan the government and the utilities share the goal of constructing safe and economical power plants expeditiously, unlike the USA and much of the rest of the world, and they have coordinated their efforts to do so.

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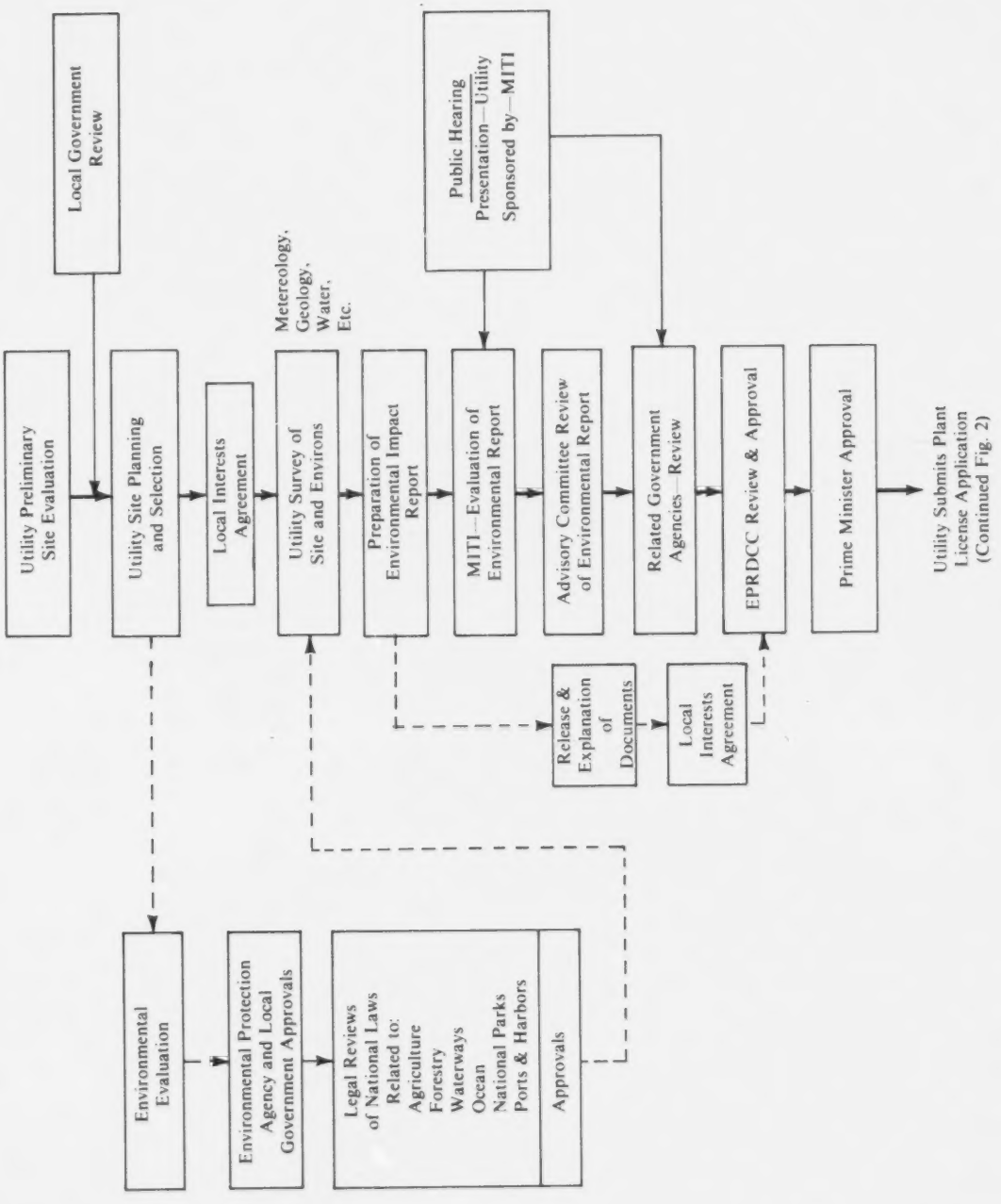

Figure 1

NUCLEAR POWER PLANT PLANNING IN JAPAN

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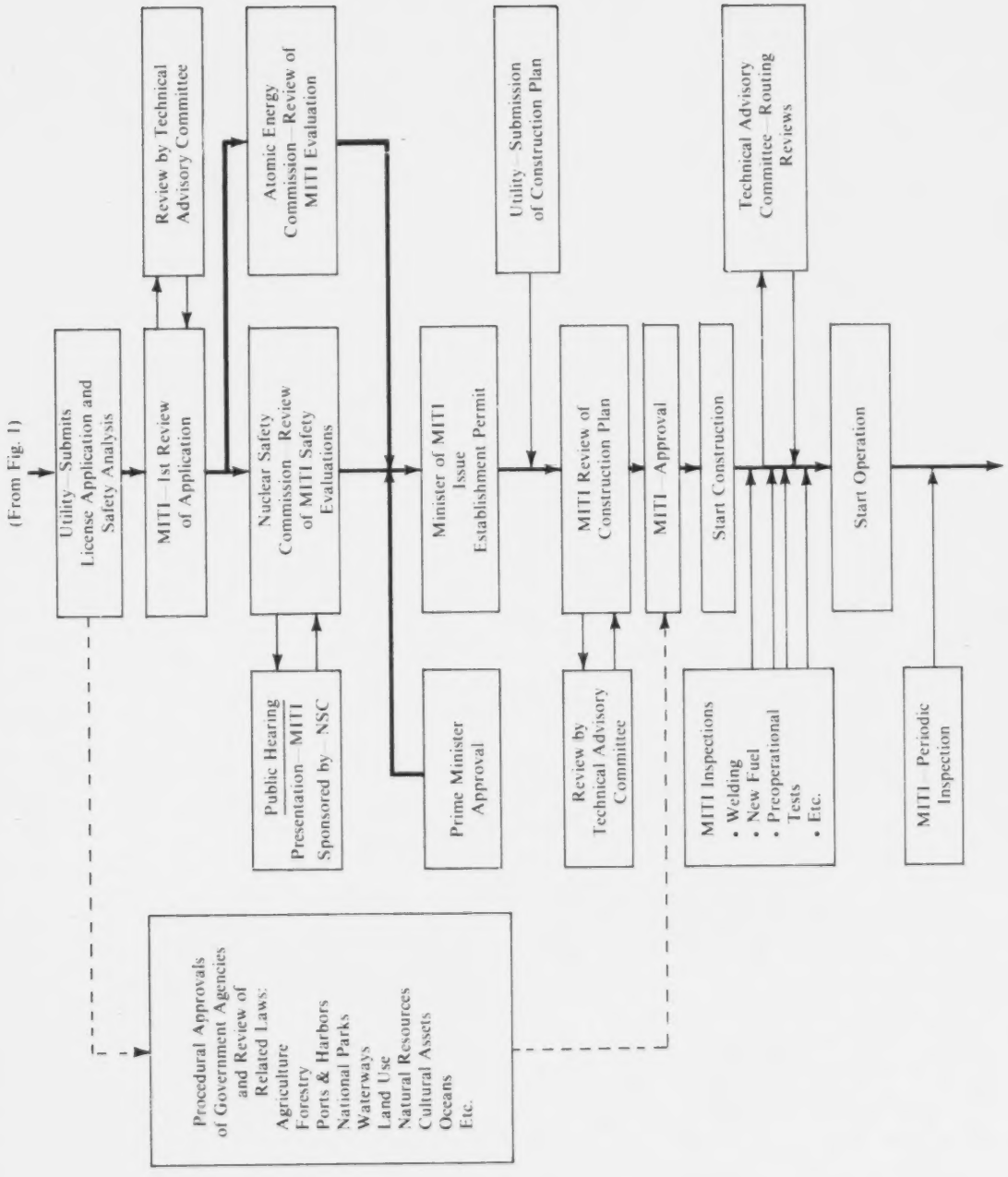

Figure 2

NUCLEAR POWER PLANT LICENSING IN JAPAN

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EURODIF

Introduction

A consortium of national nuclear fuel companies formed Eurodif in November 1973 to build a uranium enrichment plant that would fulfill the projected enrichment needs of the member nations. Construction on Eurodif's gaseous diffusion plant, located at Tricastin on the lower Rhone River in southern France, began in March 1975. The first two of four separative work process buildings began full operation in April 1979, and the plant reached full nominal capacity of 10.8 million SWUs per year in the second quarter of 1982. Eurodif has operated well below capacity for the past two years because of the excess of supply in the enrichment market.

Overview of Facilities

Eurodif's Tricastin plant spreads out over 2.5 square kilometers of land. Four 900-MWe Pressurized Water Reactors (PWRs) located adjacent to the plant and operated by Electricite de France (EDF) supply the power needed for separative work. The enrichment plant's full-capacity power requirement is approximately 3,000 MWe; its electrical switchyard alone occupies more land (40 hectares) than EDF's adjacent PWR station. An aerial view of the Tricastin site (Figure 3) shows that the dominant features of the Eurodif plant are two 123-meter-high cooling towers. Cooling of the power station condensers is provided by water from the nearby Rhone River.

The four process buildings visible in the center background of Figure 3 have varying sizes and production capacities. All four buildings contain several cells having 20 separation stages each. This compares to 8 or 10 stages per cell at the US Department of Energy's (DOE) gaseous diffusion plants. (See Report 185 of January 1984 for an overview of DOE's enrichment plants.) Each cell is insulated to maintain a necessary operating temperature of 80 degrees Celsius. The cylindrical diffuser vessels of each stage are mounted on their vertical axes, and axial flow gas compressors are situated below each vessel (Figure 4). Cells can be disconnected from the cascade for maintenance; a massive sliding door seals each cell from a main service aisle during operation. Uranium hexafluoride (UF_6) feed and product lines between cells pass beneath the floor of the service aisle.

Building 1 is approximately 100 meters square and houses 14 small-sized cells having 0.6-MWe gas compressors for each stage. Building 2, approximately 150m by 220m, contains 20 medium-sized cells having 1.5-MWe compressors. Both building 3 and building 4 are approximately 250m by 200m, and each contains 18 large-sized cells having 3.3-MWe compressors. At full capacity, each *cell* in buildings 3 and 4 can produce 200,000 SWUs per year. Diffuser vessels tower as high as 18 meters.

Feed and Enriched Uranium Handling

An overhead walkway connects the process buildings to the control room and to the UF_6 feed and product buildings. The buildings in which UF_6 is handled are subject to Euratom and International Atomic Energy Agency (IAEA) safeguards inspection. Certificates of quantity and quality accompany all cylinders and sample containers having natural, enriched, and depleted UF_6.

Quantities of UF_6 are determined by weighing cylinders and containers before and after deliveries. (Generally one cylinder contains approximately 1,500 KgU as UF_6.) Quality (isotopic assay and percentage of impurities) is determined by laboratory analysis. Two samples per cylinder of feed are taken, one for plant analysis and one for reference in case of a dispute. Ordinarily three samples of enriched product are taken per group of six cylinders having the same product assay. If the purchaser requests, and at the purchaser's expense, three samples of tails (depleted UF_6) may be taken as well.

Ownership

Originally, five nations had shares in Eurodif through state-controlled nuclear fuel organizations. The French national company Cogema (Compagnie Generale des Matieres Nucleaires), which is the fuel arm of CEA (Commissariat a l'Energie Atomique), owned the largest independent share with 27.778 percent. A joint partnership of Cogema and the Atomic Energy Organization of Iran (AEOI), known as Sofidif (Societe Franco-Iranienne pour l'Enrichissement de l'Uranium par Diffusion Gazeuse), controlled 25.00 percent. The Italian government owned 25.00 percent through two entities having 12.50 percent each, Agip Nucleare and CNEN (Comitato Nazionale per L'Energia Nucleare). A Belgian company known as Soben (Societe Belge pour l'Enrichissement de l'Uranium) owned 11.111 percent, as did the Spanish fuel company Enusa (Empresa Nacional del Uranio S.A.).

As Table 6 indicates, the ownership of Eurodif has changed. Four nations rather than five now own interests in the company, and Cogema controls 61.528 percent, as a result of two events.

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Figure 3. Eurodif plant site, showing four 900-MWe PWRs in foreground, cooling towers at left, and process buildings (one of which is not yet completed in this photo) in center background.

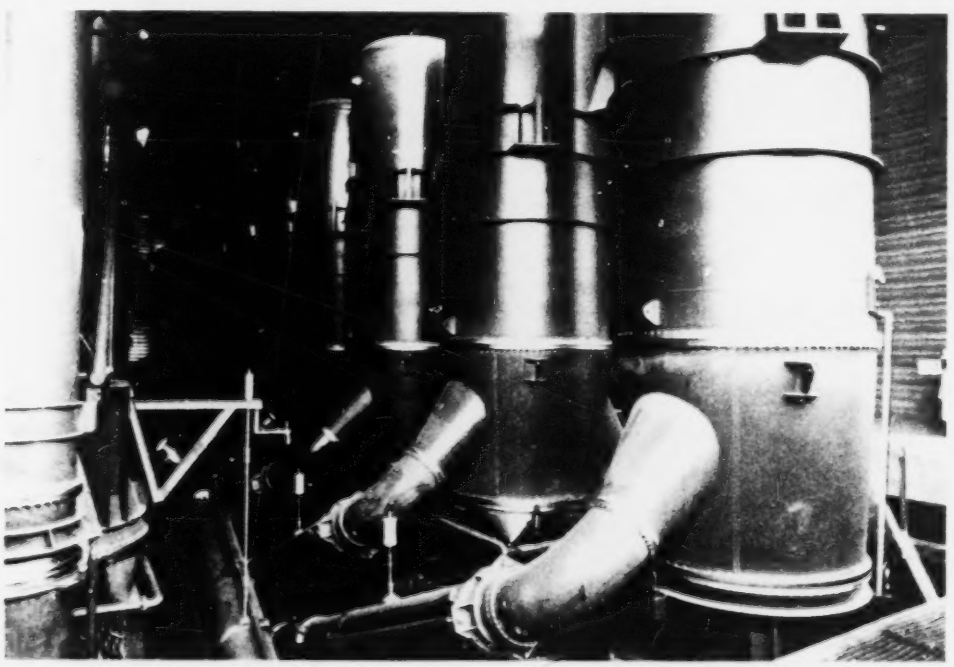

Figure 4. Small separation stages of a cell in the first process building.

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1. Sofidif became a defunct organization following the revolutionary Iranian government's default on its commitment to Eurodif. Thus, Cogema owns all of the 25 percent formerly belonging to Sofidif.

2. The Italian partners sold to Cogema 8.75 percent of their cumulative share, reducing their participation from 25.00 percent to 16.25 percent (8.125 percent each). Agip Nucleare has since changed its name to Agip Uranio, and CNEN has been superseded by ENEA (Ente Nazionale per l'Energia Atomica) (which could be considered the equivalent of DOE plus the NRC in the USA).

The total cost for the enrichment plant was in the neighborhood of FF 23 billion ($4 billion at the time). Part of the financing for the plant came from an estimated $1 billion 1975 loan provided by the Iranian government of the last Shah. When the Islamic revolutionary government repudiated its commitment to take SWUs from Eurodif, CEA froze payments on the Iranian loan.

Table 6

EURODIF OWNERSHIP

Company	Country	Percent Share
Original Owners		
Cogema[1]	France	27.778
Sofidif[2]	France / Iran	25.000
Agip Nucleare	Italy	12.500
CNEN[3]	Italy	12.500
Enusa[4]	Spain	11.111
Soben[5]	Belgium	11.111
Current Owners		
Cogema[1]	France	61.528
Enusa[4]	Spain	11.111
Soben[5]	Belgium	11.111
Agip Uranio	Italy	8.125
ENEA[6]	Italy	8.125

[1]Cogema = Compagnie Generale des Matieres Nucleaires.
[2]Sofidif = Societe Franco-Iranienne pour l'Enrichissement de l'Uranium par Diffusion Gazeuse.
[3]CNEN = Comitato Nazionale per l'Energia Nucleare.
[4]Enusa = Empresa Nacional del Uranio S.A.
[5]Soben = Societe Belge pour l'Enrichissement de l'Uranium.
[6]ENEA = Ente Nazionale per l'Energia Atomica.

Current Overcapacity

At the time Eurodif was conceived over a decade ago, all of the member nations had ambitious nuclear power plans, and DOE's enrichment capacity appeared inadequate to satisfy future demand. Moreover, for Europeans greater autonomy of fuel supply (in this case enrichment services) was extremely attractive in light of their excessive dependence on imported oil. Based on then-prevalent growth projections, the Eurodif plant's SWU capacity would fulfill demand until the mid-1980s, when a new enrichment plant known as Coredif was to have begun providing supplementary capacity.

The years 1978-1982 altered Eurodif's situation dramatically. Contrary to earlier forecasts, electricity demand growth rates declined, and almost every Western nation experienced nuclear power plant delays and cancellations. (France was the one major exception.) In the USA alone, the decline in demand growth, aggravated by the Three Mile Island (TMI) incident in 1979 and by enormous plant construction cost overruns, caused the largest nuclear power program in the world to be cut virtually in half. The reduction of nuclear power programs affected Eurodif by reducing the demand for enrichment services. Adding to the emerging problem of enrichment oversupply, DOE in 1982 completed the phasing in of 10.1 million SWUs per year of additional capacity (through the Cascade Improvement Program and the Cascade Uprating Program). That was the year Eurodif reached full annual production capacity of 10.8 million SWUs.

Plant delays and cutbacks in Italy's and Spain's nuclear programs have led Enusa, Agip and ENEA to attempt to relieve some of their commitments to Eurodif over the past two years. (Termination charges for the Eurodif partners under their original contracts are estimated to be a prohibitive 80 percent of the contracted SWU price.) They have used two methods to achieve this result:

1. Electricity-for-SWU deals with Eurodif;
2. Secondary market SWU sales.

In an electricity-for-SWU deal, the shareholder pays Eurodif for the fixed portion of the committed SWUs (estimated to be 45 percent of the total cost) and imports from EDF the power which would have been necessary to generate them. Nuexco believes that the electricity-for-SWU contracts between Eurodif, EDF and the Italian and Spanish partners contain option provisions enabling the shareholders to take the SWUs if it best serves the partners' interests to do so (i.e., if secondary market sales of those SWUs are a better alternative).

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Eurodif has reduced its power requirement from EDF substantially over the past three years. Currently the enrichment plant operates at less than 60 percent of full capacity. The plant is EDF's largest single industrial customer. In 1981 it consumed 18.1 billion kilowatt-hours of electricity; in 1982 16.9 billion kwh; and in 1983 only 9.9 billion kwh. Eurodif's electricity demand reductions caused overall industrial electricity consumption in France to decline by 3.5 percent in 1983.

Production Commitments

EDF is Eurodif's biggest customer by far, having 28 nuclear units in commercial operation and 25 more under construction. Synatom of Belgium takes Soben's share of SWU deliveries to supply the enrichment requirements for Belgium's five operational units. Enusa supplies the requirements of Spain's six operating units; four other units are scheduled to begin commercial operation in Spain by 1990. All of the SWUs purchased by ENEA are in turn committed to the Italian state utility ENEL (Ente Nazionale per l'Energia Electrica), which operates two small reactors and one 900-MWe BWR. Japanese utilities have contracts to take approximately 1 million SWUs per year from Eurodif, and other European and Asian utilities purchase directly a smaller portion of the plant's output.

Presently Eurodif, like DOE and Urenco, is competing aggressively to expand its share of the primary enrichment market. Because Eurodif contracts are denominated in French francs and the franc is currently devalued relative to the US dollar, Eurodif prices appear competitively low. (The price was FF 971, or $115–120, in December 1983.) Plans for capacity expansion such as the Coredif plant have been shelved indefinitely as Eurodif seeks simply to bring its existing operation up to capacity.

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THE ROSSING PROJECT (PART 1)

Introduction

The Rossing uranium mine is the largest open pit uranium mine in the world, processing over 15 million tons of ore each year. It is located in the Namib Desert approximately 70 kilometers east of Swakopmund, Namibia (Figure 5). A subsidiary of Rio Tinto Zinc Ltd. (RTZ) of the United Kingdom defined the deposit in the late 1960s. In 1970, RTZ created a company known as Rossing Uranium Limited (RUL) to develop and operate a mine and mill. U_3O_8 production began in mid-1976. The mine has a remaining life of 15 to 20 years given the present production rate.

Uranium Discovery

Prospectors first discovered uranium near Rossing Mountain, in a remote part of the Namib Desert, in 1928. During the next 27 years sporadic prospecting throughout a concession area of 1,200 square miles resulted in the discovery of widely disseminated uranium-bearing rocks. Uranium mineralization was found to occur primarily in alaskite, a fine- to coarse-grained granitic rock found in association with a highly-folded metamorphic rock sequence.

Figure 5

LOCATION OF ROSSING PROJECT

The first concerted action toward geologic assessment of the area came in 1955, when Anglo American Corporation secured a two-year option with the Louw syndicate, the property owner, to investigate the commercial potential of the concession. The company identified a number of radioactive anomalies, one of which it tested by diamond drilling and limited underground exploration work. During the evaluation process, geologists delineated highly disseminated mineralization averaging approximately 0.035 percent U_3O_8. However, no further action was taken and the two-year option period expired.

Commercial Development

In 1966 RTZ expressed an interest in the Namib property. RTZ had declined participation in development efforts on two previous occasions. Its renewed interest was attributable to two promising developments:

1. Emerging long-term uranium marketing opportunities;
2. Improvements in large-scale mining and mineral recovery technology.

RTZ assigned its South African subsidiary, Rio Tinto South Africa Ltd., to perform a cursory evaluation of the property. The result of that evaluation proved favorable. RTZ negotiated a six-year option with the Louw syndicate, and immediately thereafter dispatched a two-man team to begin detailed geologic studies of the concession area, which had been reduced to 400 square miles. As positive evaluation results accumulated, more technicians arrived to carry out radiometric surveys, geologic mapping, and percussion and diamond-core drilling. In 1970 the team sank a shaft on a favorable mineralized zone to obtain a large-volume ore sample for metallurgical test work. The ore sample was processed in a newly constructed pilot plant. Laboratory recovery results were confirmed, and design work proceeded on a commercial-sized recovery plant. Some 90 employees were on site at that time.

Also in 1970, RTZ created a subsidiary company known as Rossing Uranium Limited (RUL) to operate the project. RUL completed orebody evaluation in May 1973. Coincidental with the last phase of evaluation activity, RTZ negotiated sales of future U_3O_8 production and arranged project financing. The corporate decision to proceed with project development came in August 1973.

Open-pit mining and construction of a processing plant began in mid-1974. The mill started operating in March 1976 and produced the first U_3O_8 three months later. A series of start-up problems, including a fire that de-

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Figure 6. Aerial view of Rossing Project, Namibia. Open pit is at right center, mill and tailings dam lower left of photo. Note ore conveyor delivery system from mine to mill. Mined ore is crushed (1) and delivered by conveyor to stockpile (2) for secondary crushing and delivery by conveyor to the mill (3).

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stroyed part of the solvent extraction unit, and subsequent design modifications delayed the original production schedule. However, by 1979 annual production had reached approximately 10 million pounds U_3O_8, the largest production rate of any operating uranium mine in the world. Annual production has continued since at that level. (Figure 6 shows an aerial view of the project.)

RTZ sold shares of RUL to a diverse group of mining and investment companies in the mid-1970s (Table 7). Having a net beneficial interest of 46.5 percent, RTZ controls the largest share of the company. Industrial Development Corporation of South Africa controls 13.5 percent. Minatome of France originally held a 10-percent interest; title of that share shifted to Total Compagnie Miniere when Total took over Minatome in 1982. Rio Algom Ltd. of Canada also has 10 percent. Urangesellschaft GMBH of the Federal Republic of Germany holds 5 percent, and General Mining Corporation of South Africa has 2.3 percent. The remaining 17.85 percent is held by several companies and/or national entities that participate under strict provisions of secrecy. Their names have not been revealed publicly by RUL.

Table 7

OWNERSHIP OF ROSSING URANIUM LTD.

Company	Country	Percent Share
Rio Tinto Zinc Group PLC[1,2]	UK	41.35
Industrial Development Corp.	South Africa	13.5
Total Compagnie Miniere	France	10.0
Rio Algom Ltd.[1]	Canada	10.0
Urangesellschaft GMBH	FRG	5.0
General Mining Corporation	South Africa	2.3
Other	—	17.85

[1]RTZ owns 51.3% of Rio Algom, so RTZ's net beneficial interest in Rossing is 46.5%.
[2]RTZ is now Rio Tinto Zinc Group PLC.

Exploration and Surface Evaluation

Rio Tinto South Africa introduced a multi-functional geophysical program in the early stages of exploration. Airborne radiometric and magnetic surveys were conducted over a large part of the general concession area. Ground surveys followed on zones of known mineralization and on newly discovered anomalies. Ground radiometrics eventually were concentrated in a 75-square-mile area, determined as the primary area of interest. The approximate outline of the Rossing deposit was eventually established within an area of approximately two square miles as a result of detailed radiometrics, geologic mapping and rock sampling.

Rio Tinto initiated percussion drilling on the deposit site to determine the distribution of uranium. Overall, 250 holes were drilled at an incline of -45 degrees on a north-south-oriented grid pattern. The holes averaged 120 feet in drilled depth for an accumulated total of 30,000 feet. Drilling confirmed an even distribution of uranium mineralization across the surface formations.

The next period of project evaluation entailed deeper drilling. Rio Tinto completed over 182,000 feet of coring in two phases during the period May 1967-June 1971. All but two holes were drilled on an incline of -45 degrees to the north for better penetration of the steeply dipping rock formations. During the first phase, the holes were drilled to a depth of 400 to 1,000 feet, depending on topography and rock characteristics. Spacing followed 400-foot centers along north-south grid lines. The second phase of holes, some drilled as deep as 1,800 feet, also followed 400-foot spacing within the same grid system and thus reduced hole spacing to 200 feet. Two holes located near the central portion of the ore deposit were drilled to a vertical depth of 1,500 feet, which was then considered the approximate depth limitation of minable ore.

Underground Evaluation

Underground bulk sampling made a major contribution to ore deposit evaluation. A 375-foot vertical shaft strategically located on the deposit provided access to the ore. Main drifts were driven east and west from the shaft bottom to the outer limits of the ore. Next, crosscut drifts were driven north and south off the mains, paralleling the surface drill sections. The crosscuts intersected a number of drill holes. Horizontal long-hole drilling preceded drift advance, enabling pre-classification of rock type and ore values in relation to waste rock. Over 9,000 feet of underground development drifting had been completed by December 1971.

The underground program allowed close coordination with the surface drilling results. The combined results provided useful geologic information regarding structural and stratigraphic features, distribution of uranium mineralization, and ratio of ore to waste. Final distribution and grade of mineralization were accurately estimated through radiometric and chemical analysis of carefully selected and prepared core samples and underground bulk samples. An official ore reserve estimate has not been issued for the deposit. However, Nuexco has reported reasonably assured resources of 100,000 tons U_3O_8 at an average grade of 0.035 percent (see World Uranium Resources, Nuexco Special Report, November 1980).

Part 2 of the article on the Rossing Project will focus on project development and the geology of the deposit.

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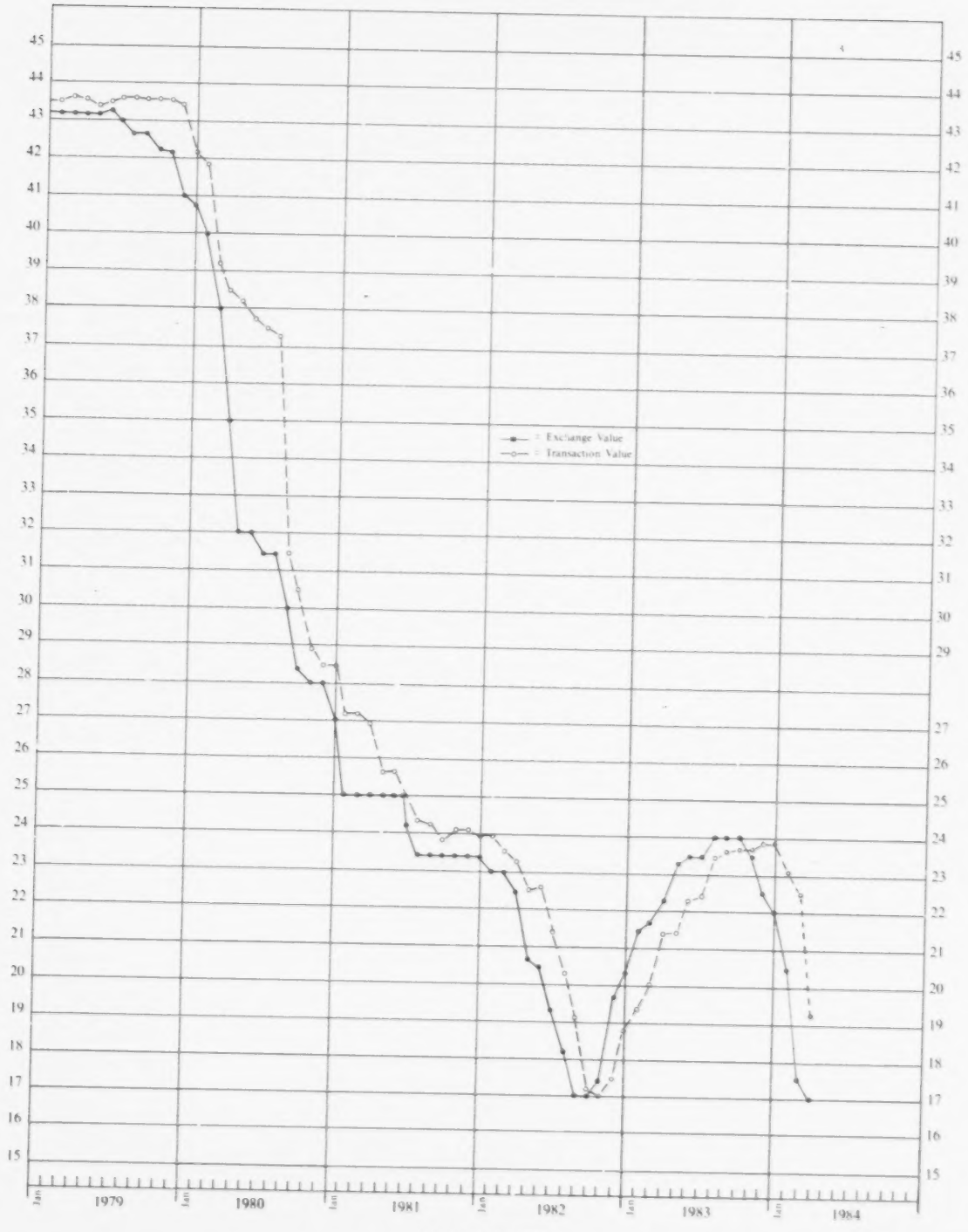
EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	**17.00**									

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	**19.25**									

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	**0.80**									

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates[2] (1976=100)
1972 Avg.	105.6	71.3
1973 Avg.	124.4	79.0
1974 Avg.	141.9	108.1
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3] [4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	—	181.8R
Jan 1983	385.7	179.6
Feb 1983	387.5	179.8
Mar 1983	397.4	179.7
Apr 1983	407.3	180.0
May 1983	414.8	180.1
Jun 1983	415.6	180.2
Jul 1983	408.4	179.9
Aug 1983	403.1	179.9R
Sep 1983	403.1	179.8R
Oct 1983	397.6	187.6R
Nov 1983	395.3P	187.6R
Dec 1983	—	187.4R
Jan 1984	—	187.6P

P = Preliminary R = Revised since last month

[1]Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).
[2]Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.
[3]Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.
[4]Annual averages prior to 1979 reflect index base no longer in use.
[5]Monthly data for 1979-82 appear on page 35 of Report 184.

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GOVERNMENT STATISTICS

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971=100)	Wage-earner Data: Average Hourly Earnings (C$)[2]						
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	(SIC 296-298)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 370-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	7.35	—	7.67
1980 Avg.	247.2	—	10.59	10.80	—	8.05	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	9.03	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	9.98	—	10.63
1983 Avg.	298.8R	—	14.68R	14.40R	—	—	—	11.28R
Jan 1983	292.7	—	14.36	14.35	—	10.72	—	11.06
Feb 1983	293.5	—	14.24	14.28	—	10.74	—	11.06
Mar 1983[8]	295.2	16.79	14.84	14.48	—	10.93	—	11.21
Apr 1983	297.1	16.83	14.40	14.13	11.57	—	10.10	11.02
May 1983	298.5	17.02	14.50	14.10	11.39	—	9.82	10.97
Jun 1983	299.3	17.02	14.60	14.07	11.33	—	9.84	11.05
Jul 1983	300.4	16.48	14.35	13.93	11.70	—	9.83	11.04
Aug 1983	301.3R	16.93	14.36	13.89	11.82	—	10.08	11.19
Sep 1983	301.1R	17.66	14.90	14.41	11.99	—	10.32R	11.29
Oct 1983	301.6R	17.73	15.27	14.65	11.76	—	10.03	11.30
Nov 1983	301.7	17.85R	15.24R	15.31R	12.43R	—	11.39R	12.00R
Dec 1983	302.7R	17.88	15.10R	15.23R	12.69R	—	11.33R	12.12R
Jan 1984	304.9R	—	—	—	—	—	—	—
Feb 1984	306.3P	—	—	—	—	—	—	—

P = Preliminary R = Revised since last month

[1]Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision.

[2]Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3]Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)".

[4]Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5]Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6]Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7]Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read Total Mining (SIC 051-099)".

[8]Beginning with the April 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to April 1983 only companies employing fewer than 200 wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Consumer Price Index[2] (1975 = 100)[3]	Producer Price Index All Groups[4] (1975=100)	Total Employment in Mining and Quarrying (Code 35)[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[5]
1972 Avg.	8.79	113.3	63.9	623,067	443,933
1973 Avg.	10.51	124.1	72.3	684,743	572,133
1974 Avg.	13.18	138.5	85.3	674,140	761,596
1975 Avg.	16.71	157.2	100.0	639,473	1,003,617
1976 Avg.	19.30	174.7	115.1	671,240	1,212,983
1977 Avg.	23.87	194.4	130.0	712,006	1,420,670
1978 Avg.	27.14	137.2	142.7	664,571	1,537,169
1979 Avg.[6]	30.18	155.3	164.5	692,209	1,830,632
1980 Avg.[7]	35.53	176.7	192.1	714,379	2,279,615
1981 Avg.	41.89	206.5	218.3	728,506	2,820,505
1982 Avg.[8]	47.25	233.5	248.7	707,552	3,246,071
1983 Avg.	51.87	262.2	274.8	696,579	3,644,772
Jan 1983	—	249.0	264.9	688,030	289,075
Feb 1983	—	253.1	267.4	697,089	281,413
Mar 1983	50.35	255.9	269.1	695,976	290,586
Apr 1983	—	257.8	270.9	697,158	286,708
May 1983	—	259.7	274.1	701,712	295,701
Jun 1983	50.51	260.8	273.1	706,933	300,177
Jul 1983	—	262.5	273.7	704,202	314,566
Aug 1983	—	265.6	278.9	698,984	311,789
Sep 1983	52.92	267.3	279.4	696,435	312,264
Oct 1983	—	270.0	281.0	693,225	311,418
Nov 1983	—	271.4	281.6	688,459	317,485
Dec 1983	53.70	273.2	283.7	690,750	333,595
Jan 1984	—	274.7	283.3	—	—
Feb 1984	—	278.4	—	—	—

[1]Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly. The tonnage-weight index of average working costs per metric ton of gold ore milled for 1983 follows. (Base: March quarter 1982 = 100). See page 16 of Report 178 for the description and calculation of index, and page 24 of Report 178 for figures for 1982.

1983:	January-March	111.2
	April-June	111.9
	July-September	117.4
	October-December	119.6

[2]Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3]For annual averages prior to 1978, April 1970 = 100.
[4]Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same.
[5]Bulletin of Statistics, Department of Statistics, Pretoria.
[6]Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.
[7]Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.
[8]Monthly data for 1979-82 appear on page 39 of Report 184.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967=100)	All Commodities (1967=100)	(1967=100)	(1972=100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1972 Avg.	117.9	119.1	125.3	100.00	4.56	4.59	4.26	3.71
1973 Avg.	125.9	134.7	133.1	105.75	4.84	4.98	4.51	3.91
1974 Avg.	153.8	160.1	147.7	115.08	5.44	5.63	4.88	4.21
1975 Avg.	171.5	174.9	161.2	125.79	6.13	6.24	5.39	4.64
1976 Avg.	182.4	183.0	170.5	132.34	6.76	6.87	5.91	4.96
1977 Avg.	195.1	194.2	181.5	140.05	7.28	7.67	6.43	5.39
1978 Avg.[5]	209.4	209.3	195.4	150.42	8.23	8.56	7.02	5.82
1979 Avg.	236.5	235.6	217.4	163.42	9.27	9.50	7.60	6.32
1980 Avg.	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[6]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63R	12.67	13.44	10.58	8.66
Jan 1983	313.9	299.9	293.1	—	12.63	13.33	10.34	8.53
Feb 1983	313.9	300.9	293.2	—	12.66	13.29	10.41	8.56
Mar 1983	313.5	300.6	293.4	212.83	12.48	13.35	10.39	8.60
Apr 1983	312.4	300.6	295.5	—	12.67	13.34	10.43	8.60
May 1983	313.6	301.5	297.1	—	12.55	13.62	10.50	8.60
Jun 1983	315.3	302.4	298.1	214.55	12.66	13.38	10.52	8.63
Jul 1983	316.5	303.2	299.3	—	12.68	13.56	10.58	8.69
Aug 1983	317.3	304.7	300.3	—	12.63	13.46	10.61	8.64
Sep 1983	317.1	305.3	301.8	216.44	12.71	13.47	10.69	8.75
Oct 1983	318.5R	306.0R	302.6	—	12.78	13.56	10.78	8.73
Nov 1983	318.3	305.6	303.1	—	12.72	13.56	10.86	8.78
Dec 1983	318.4	306.0	303.5	218.53R	12.85	13.34R	10.89	8.86R
Jan 1984	319.2	308.1	305.2	—	12.79	13.38	10.89R	8.90R
Feb 1984	320.4	308.8	306.6	—	—	—	10.89	8.88

P = Preliminary R = Revised since last month

[1]US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2]US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3]US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4]US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." 2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5]Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[6]Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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